GLIOMATOSIS OF THE PIA AND METASTASIS OF GLIOMA.*

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Various forms of malignant tumor may implicate the pia of the spinal cord and brain diffusely. The sarcomatous infiltration is the best recognized. The first case of this kind reported in America, so far as I know, is that of George K. Weaver,[1] in 1898. In 1903 I[2] reported two cases, one in association with W. F. Hendrickson, and the present communication is made in relation to one of these. Since then two cases have been recorded by F. X. Dercum.[3] The German literature contains the largest number of cases and a few may also be found in the British journals.

Sarcomatous infiltration, however, is not the only form of diffuse tumor formation of the pia. The carcinoma and glioma have been known to appear in this manner. An important paper in regard to gliomatosis of the pia has recently been published by Grund.[4] This author says that the earliest mention of glia proliferation in the pia is by Klebs, who found glia in the pia near a glioma of the brain. He cites Alzheimer as authority for the statement that glia proliferation in the pia is common in paretic dementia. Schlesinger and Saxer have seen proliferation of glia in the pia in syringomyelia. Schlesinger, in his monograph on tumors of the spinal cord, makes no mention of diffuse glioma in the pia arising from the neuroglia, but since the publication of his monograph four cases have been reported (Leusden, Fränkel and Benda, Fischer, Roux and Paviot) and Grund adds one more, but does not refer to my case, so that at the present time six cases of gliomatosis of the pia are on record.

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[1] Weaver. Journal of Experimental Medicine, 1898, Vol. III., No. 6.

[2] Spiller and Hendrickson. American Journal of the Medical Sciences, July, 1903.

[3] Dercum. Philadelphia Hospital Reports, Vol. V., 1903, and Journal of Nervous and Mental Disease, March, 1906, p. 169.

[4] Grund. Deutsche Zeitschrift für Nervenheilkunde, Vol. XXXI., Nos. 3 and 4, p. 283.

*Read before the Pathological Society of Philadelphia, Feb. 14, 1907.

The glioma, unlike the sarcoma, carcinoma, endothelioma or perithelioma, is not a sharply defined tumor of the nervous system, but infiltrates into the surrounding tissue, and it is owing to this fact that its surgical removal is so difficult. Indeed, I[5] have advocated leaving the tumor untouched if at the operation it can be shown to be a glioma. In the striking language of Walton and Paul,[6] one might as well attempt to remove the decayed spot from a fruit in order to arrest the process of destruction as attempt to remove a glioma in order to arrest the tumor formation. It may be possible, however, when the glioma is very minute, to remove surgically sufficiently surrounding brain tissue to prevent further progress of the growth.

Unlike sarcoma, glioma seldom extends into the membranes of the brain or cord, and never breaks through beyond the membranes. Glioma, unless very cellular and closely resembling sarcoma, grows very slowly. Max Borst,[7] in his work on tumors, has a very interesting chapter on glioma, and according to him cavities in a glioma lined with cylindrical cells are rare, but in this finding the embryonal relation of the glia cells to the ependyma may be recognized. Glia cells as derivatives of ependymal cells may have the power to return to the type of epithelium of the primary neural canal, or the cylindrical cells in the glioma may be regarded as separations from the ependymal cells of the ventricles from which the glia cells of the tumor are derived. Both conditions are possible.

The term gliosarcoma has fallen into some disrepute, as it implies an origin from both mesoblastic and epiblastic tissues, but Borst employs the term for the mixed tumor and calls the glioma rich in cells glioma sarcomatodes. The distinctions between glioma and sarcoma may be difficult to make. The presence of glia fibers does not make a tumor a glioma, especially if the fibers are near the border of the tumor, as

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[5] Spiller and Frazier. University of Penna. Med. Bul., September, 1906.

[6] Walton and Paul. JOURNAL OF NERVOUS AND MENTAL DISEASE, August, 1905, p. 481.

[7] Borst. Die Lehre von den Geschwülsten, Vol. I.

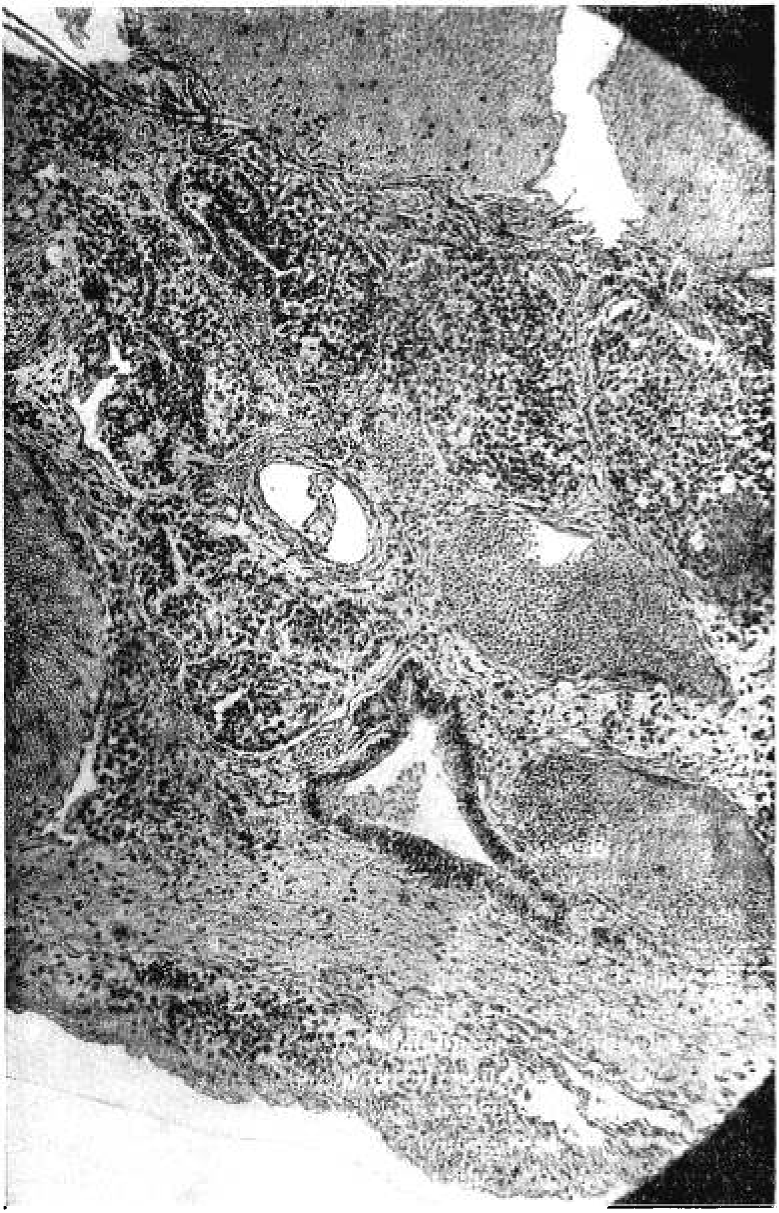

Fig. 1. Diffuse tumor formation of the pia of the spinal cord with rows of ependymal cells inclosing spaces.

they may be the remains of neuroglia caught within the tumor, and glia fibers, Borst states; occur in almost every growing tumor of the central nervous system. Sometimes what are supposed to be glia fibers are really fibrin fibers, and these may closely resemble the glia fibers, and they have no connection with the glia cells. Borst even goes so far as to say that it is uncertain whether a glioma may not be composed entirely of cells, *i. e.*, may be without fibers, and he implies that such a form of glioma may occur, the differentiation of such a tumor from a sarcoma might therefore be impossible.

In a case reported by me in 1903, to which reference already has been made, very many minute tumors and tumor infiltration were found in the pia of the spinal cord. The structure of this tumor infiltration of the pia was so extraordinary that I hardly knew what name to give to it. It resembled closely tumor arising from the ependyma, (See fig. 1.) but I could find no record at that time of gliomatous infiltration of the pia, and none of the eminent pathologists I consulted had ever heard of such an occurrence. I recorded the findings as follows:

"The tumors everywhere have much the same structure. They consist of round or somewhat elongated cells, and even by Mallory's neuroglia stain contain very little intercellular tissue. In some places the cells are distinctly columnar and resemble those of the ependyma. The columnar cells are arranged in long rows and have a large nucleus situated at one end of the cell. These rows of cells are found especially about the blood vessels, but also where there are no blood vessels. There is unquestionably a close resemblance between these cells and those of the ependyma, and the temptation, therefore, is to call the tumor an ependymoma, but it seems remarkable that an ependymoma, being a form of glioma, should give extensive metastasis to the pia of the spinal cord, which is of mesodermic origin. This, and the absence of glia fibers between the cells, and the distinct tendency to the formation of rows of cells about the blood vessels, seem to justify the classification of the tumors under the sarcomata, possibly endotheliomata or peritheliomata; and yet the close resemblance of some of these cells to those of the ependyma may permit us to regard the growth as a mixed one, and as being

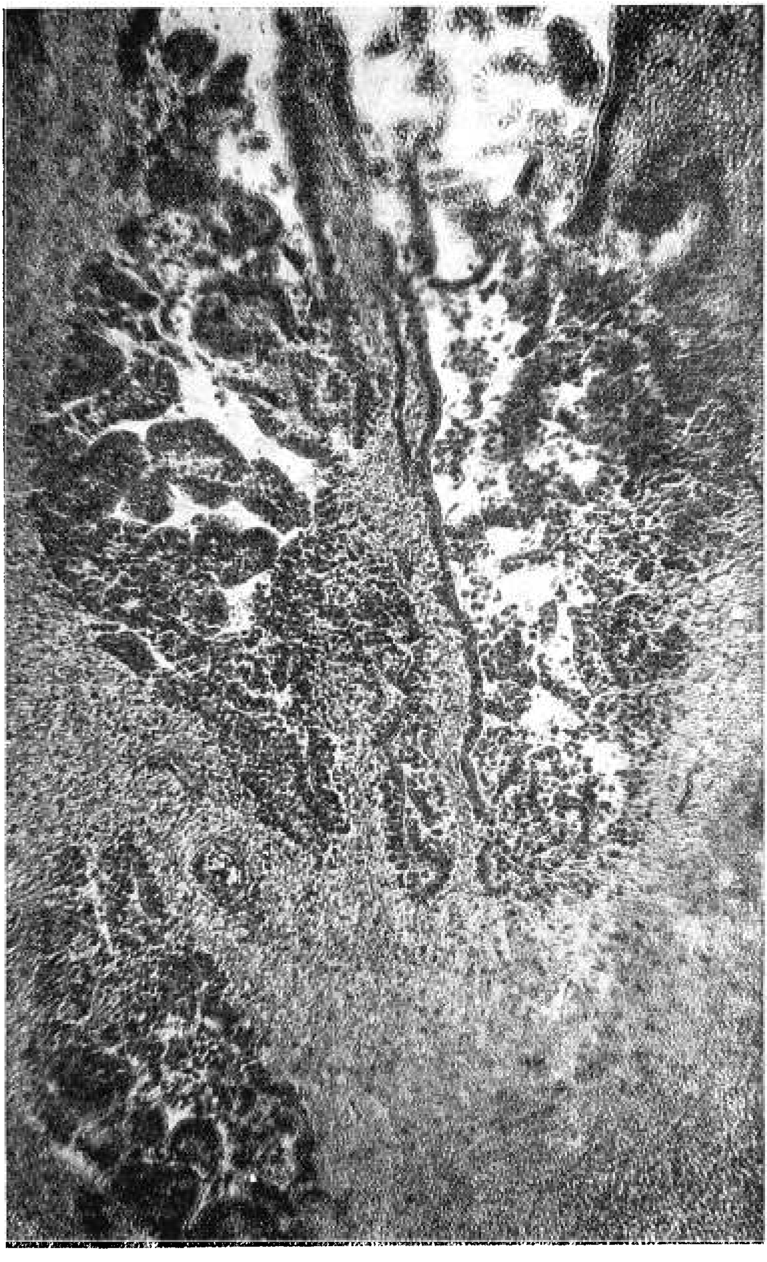

Fig. 2. Tumor filling the fourth ventricle. The proliferation of the ependymal lining is clearly shown.

partly a sarcoma and partly an ependymoma. The ependyma is known to proliferate in cases of syringomyelia when the cavity extends to the central canal and to cover in part the wall of the cavity. It is not unreasonable to suppose that a sarcoma growing from the pia may extend to the fourth ventricle, and by irritation of the ependyma lead to its proliferation, and cause in this way a mixed tumor." I referred to the fact that the tumors of the pia in this case had a resemblance to the neoplasms described by Rosenthal, Fränkel and Benda.

Since the publication of this paper the possibility of diffuse gliomatosis has been in my mind, and I have been waiting for further evidence of its occurrence, and this is now given in Grund's paper. I am now inclined to regard the sarcomatous nature of the tumor infiltration in my case as doubtful, and I look upon the growth as multiple gliomatosis. A section from the medulla oblongata shows a tumor filling the posterior part of the fourth ventricle, and the proliferation of the ependymal cells lining this ventricle is so pronounced that the ependymal origin of the diffuse process seems fully demonstrated. (See fig. 2.) These cylindrical cells no longer form a row lining the ventricle, but occur in long rows, or bordering papillomatous processes, clearly arising from the ependyma, and extending outward into the tumor.

In another case, reported by me[8] briefly from a clinical aspect and with scarcely any reference to the pathological findings, a tumor filled the posterior part of the fourth ventricle and extended downward upon the cord as low as the sixth cervical segment. This tumor also contained rows of cells resembling those of the ependyma, and forming the lining of large irregular spaces. It was an ependymoma. Another, but smaller tumor, having the same structure, was found upon the lower part of the thoracic region of the cord and was probably a metastatic growth, and therefore exceedingly interesting. Borst says that metastasis of glioma is exceedingly rare, and that Stroebe in one case saw regionary metastasis, *i. e.*, near the original tumor. Multiple gliomata, according to Borst, have not positively been observed.

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[8] Spiller, Musser and Martin. University of Penna. Med. Bul., March and April, 1903.